MANITOBA

Environmental Management Division
Environmental Control Services

Environmental Control Programs

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Source Testing for Particulate Emissions

From the Mohawk Oil Company Limited

Ethanol Distillery

Minnedosa, Manitoba

1984

Environmental Control Services,
Department of Environment and
Workplace Safety and Health.

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ABSTRACT

In July 1984 a series of three isokinetic source emission tests were conducted on the east stillage drier stack of The Mohawk Oil Company Limited distillery at Minnedosa, Manitoba. During the testing program the average particulate concentration was 0.04 g/dscm*. This is in compliance with Clause 1 of Clean Environment Commission Order No. 962 limiting emissions of particulate matter to 0.57 g/dscm.

* grams/dry standard cubic metre

INTRODUCTION

Mohawk Oil Company Limited purchased and renovated a distillery in the Town of Minnedosa to produce fuel alcohol from cereal grains. The alcohol produced from the plant is blended with gasoline to produce an automobile fuel known as gasohol. Modifications to the existing plant, formerly known as "Canada's Manitoba Distillery", included stillage drying, adding a dehydration column and increasing energy efficiency.

On October 7, 1982 the Clean Environment Commission issued Order No. 962 to Mohawk Oil Company Limited pursuant to The Clean Environment Act. Clause 1 of the order states that "The Applicant shall not permit the emission of particulate matter from any process of the said operation in excess of 0.57 grams per standard cubic metre, calculated at 25 degrees Celsius and 760 millimetres of mercury ..."

PROCESS DESCRIPTION

The production of alcohol from grain involves two main processes: fermentation and distillation. A process flow diagram is shown in Figure 1. When cereal grains arrive at the plant they are loaded into 176 m^3 bulk storage silos via screw conveyors and bucket elevators. The grains are cleaned of dirt, husks and chaff on a scalper and then stored in day bins. Particulates are removed from the exhaust air by a cyclone.

Cleaned grain is then reduced to 1 mm particle size by a hammer mill and pneumatically conveyed into a meal bin. A baghouse is used to remove particulates from conveying air prior to discharge.

Granular grain and water are then mixed in a cooker and heated by steam injection to 116°C producing mash. This temperature is maintained until all the starch is released into solution. A barometric condensor is used to cool the mash under vacuum after the pressure has been released to atmosphere. Enzymes are added at this point to change starch into sugar. When the mash has cooled sufficiently it is transferred into a fermenter along with cleaning water from the plant. Yeasts are used to convert sugar into ethyl alcohol and carbon dioxide. The carbon dioxide is expelled to atmosphere while the alcohol and water mixture, known as beer, is transferred to the beer well and then into the top of the first of three distillation columns. The ethyl alcohol is separated from the stillage by injecting steam into the bottom of the beer still. A vapour mixture of 50% ethyl alcohol and 50% water exits at the top of

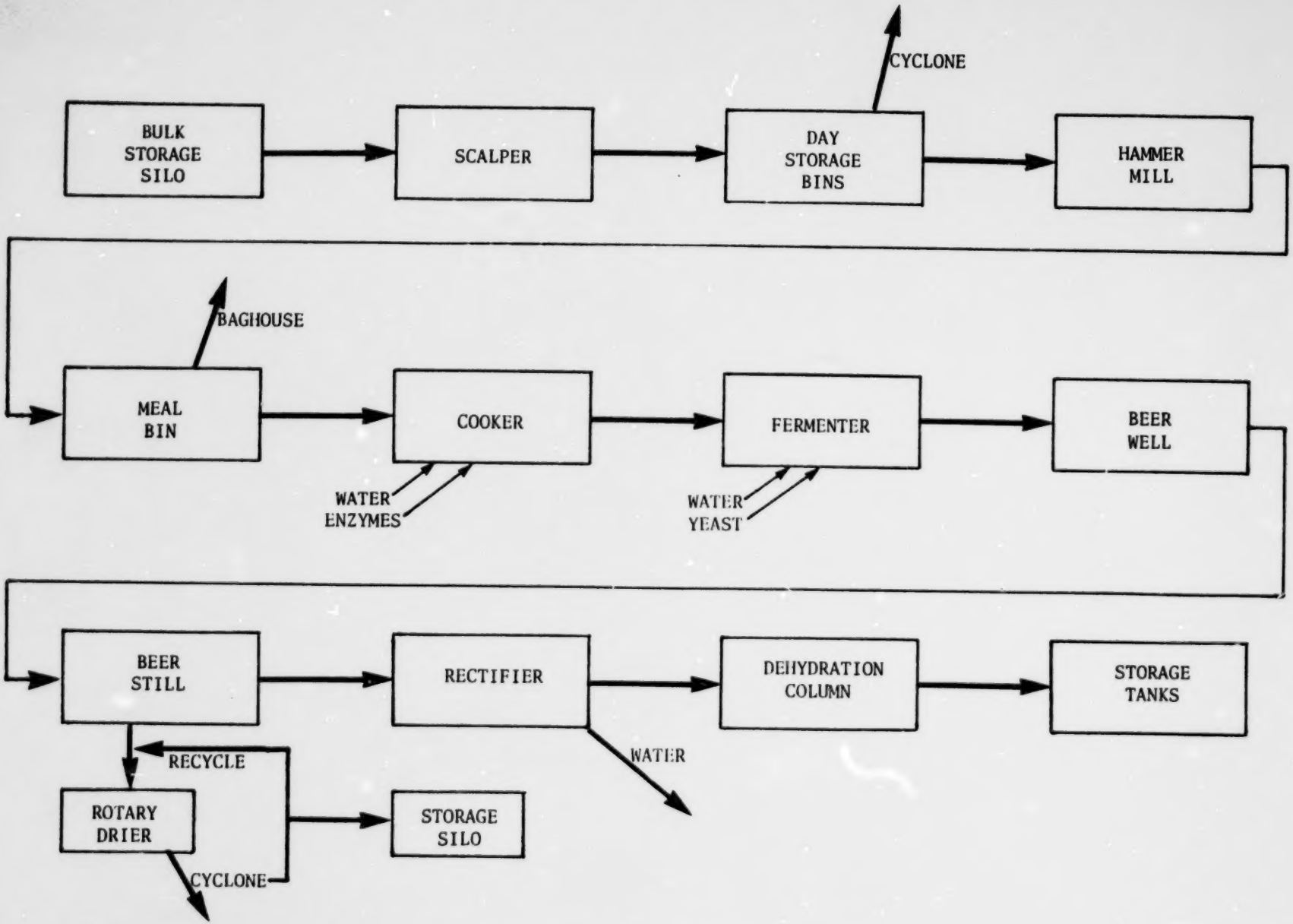

FIGURE 1: SIMPLIFIED PROCESS FLOW DIAGRAM OF THE MOHAWK ETHANOL DISTILLERY.

the beer still where it is transferred to the rectifying column where excess water is removed from the alcohol. This water is pumped to the Town of Minnedosa sewage treatment plant. Vapours that do not condense in the rectifying column are scrubbed of their organic components and released to atmosphere through a vent.

Stillage from the beer still is mixed with recycled dry product and then conveyed to a Heil three pass rotary drier. This special drier prevents charring of the stillage while moisture is being removed. A cyclone is used to separate cooling air from dried product which is transferred to a product storage silo to await shipment by truck.

A process known as azeotropic distillation converts 96% alcohol from the rectifier into 100% alcohol. This is accomplished by mixing the alcohol with cyclohexane, a dehydrating agent, and then distilling it. The pure alcohol is cooled, mixed with gasoline to denature it and then transferred to storage tanks.

PROCESS SCHEDULE

During the sampling period the Heil drier was fed with an average of 50 to 55 litres/minute (11 to 12 gallons/minute) of stillage containing an average of 10% solids by weight. The stillage was approximately 80% corn and 20% barley. The average recycle rate for the stillage was 85 to 95%.

TEST PROCEDURES

Sampling was conducted through two 7.6 cm (3 in.) ports located at right angles to each other (southwest and northwest), 6.1 m (20 ft.) above the cyclone exit and 6.1 m (20 ft.) below the top of the stack. At that point the stillage drier stack had a continuous inside diameter of 78.7 cm (31 in.), which was equivalent to 8 duct diameters downstream of the nearest flow disturbance and 8 duct diameters upstream of the stack exit. Figure 2 depicts the stillage drier stack. Six points were sampled along each traverse according to Environmental Protection Service (EPS) Method A specifications. The sample points, located 3.5, 11.6, 23.2, 55.5, 67.1 and 75.2 cm respectively from the stack wall are depicted on a cross section of the stack in Figure 3. Sampling intervals were five minutes per point.

Source emission testing was conducted according to EPS Method E. Figure 4 illustrates the particulate stack sampling train. The sample was drawn into a 6.10 mm (0.240 in.) nozzle, through a heated probe and into a miniature cyclone which removed particulate matter of greater than 10μ diameter. The sample was then passed through a Whatman 934 AH glass microfiber filter, supported by a porous fritted glass disc, which removed particulates of 0.3μ diameter and greater. Both the cyclone and the filter were heated to prevent moisture from condensing at that point. The sample was then passed through four 500 ml Greenburg-Smith impingers connected in series in an ice bath. Three impingers had modified straight tips while the second which was of the standard design. The first and

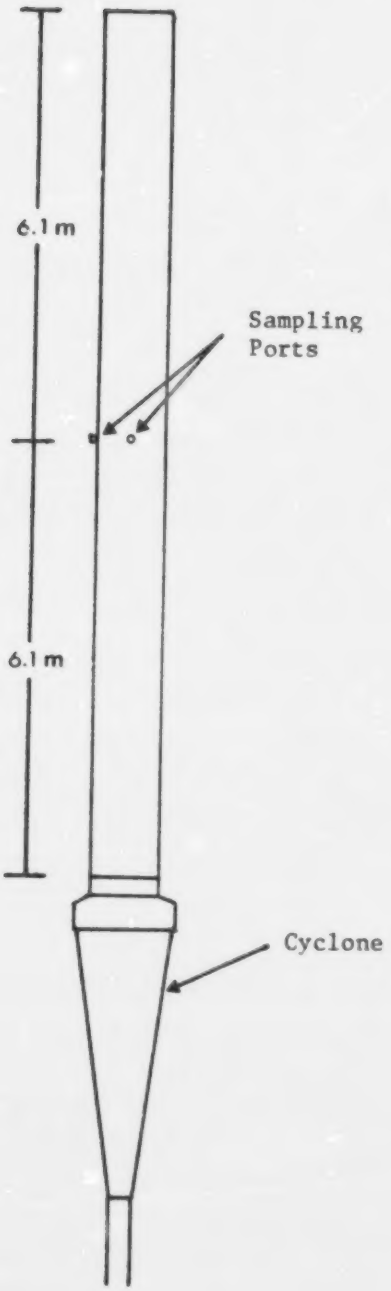

FIGURE 2: EAST STILLAGE DRIER STACK

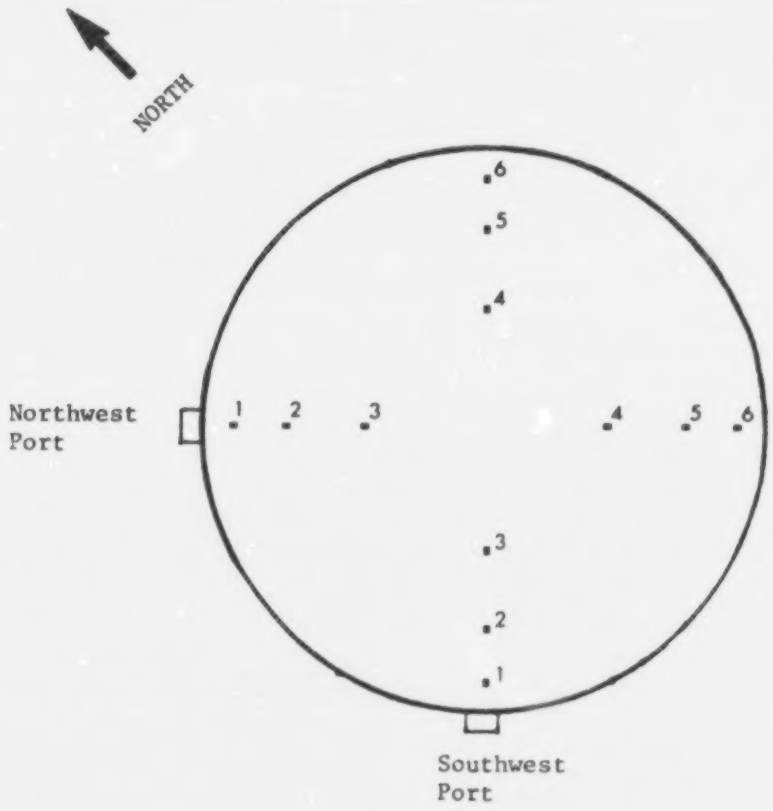

FIGURE 3: Stack Cross Section Showing Sample Points.

second impingers contained 100 ml of deionized water. The third impinger was left empty while the fourth contained 200 grams of indicating silica gel which removed remaining moisture from the gas sample.

A Bendix Series 4500 Isokinetic Stack Sampler was used to extract the samples from the stack. Gas velocity in the stack was measured with an S type pitot tube and a Dwyer Model 2001C Magnehelic Differential Pressure Gauge (range 0 to 1" H_2O, minor division 0.02" H_2O). Dry gas meter and pitot tube calibration data sheets are located in Appendix A. A Hays-Republic Model 621A Gas Analyzer was used to determine CO_2, O_2 and CO content of the stack gas. Stack temperature was measured by a K type thermocouple.

After sample recovery from the stack train, samples were submitted to the W. M. Ward Technical Services Laboratory for subsequent gravimetric analysis of particulates.

The sampling team consisted of Kevin Reeve and Tim Higham.

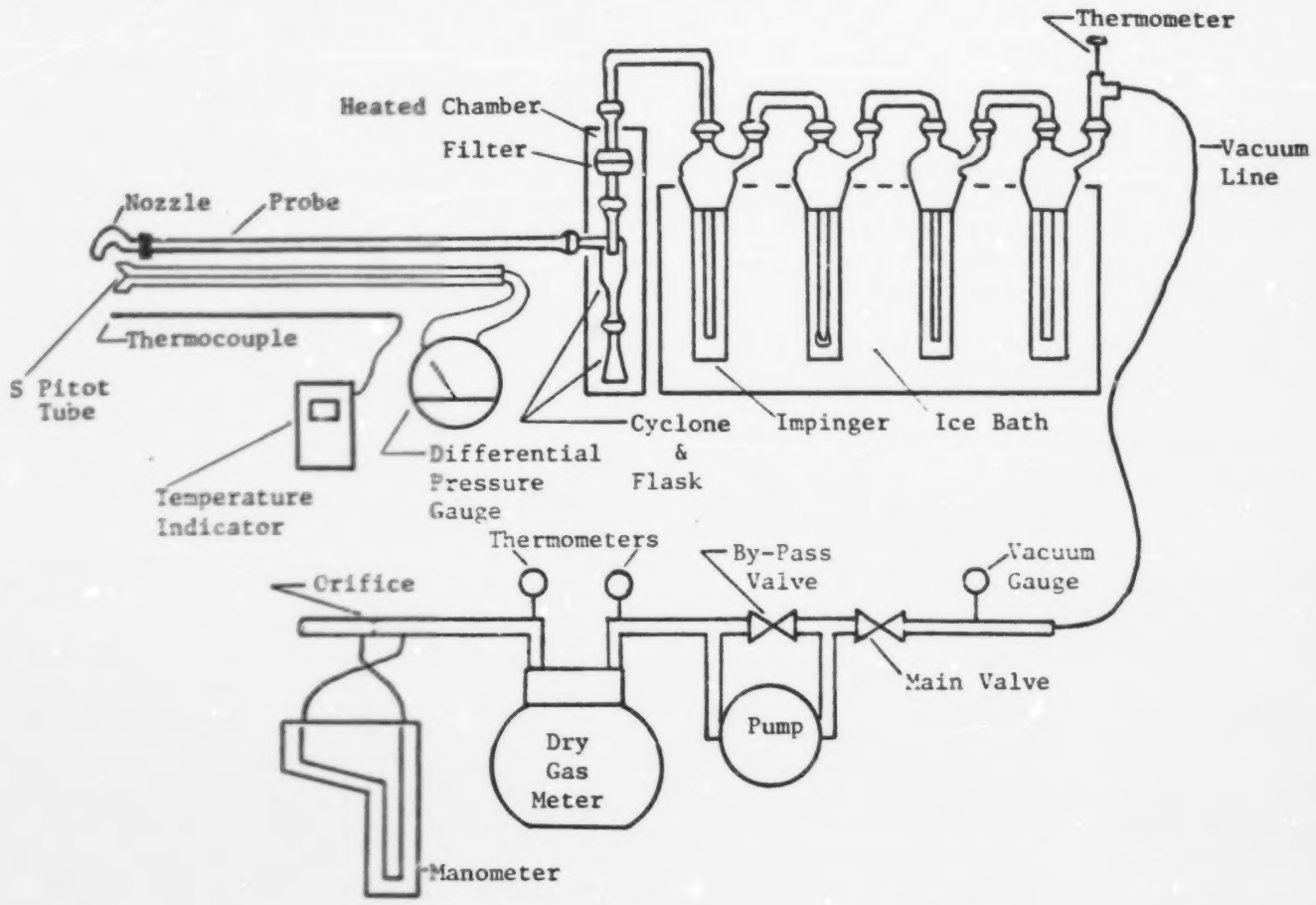

FIGURE 4. Particulate Stack Sampling Train

RESULTS

Stack velocity profiles, which were relatively uniform throughout the testing program, are illustrated by Graphs 1 through 6 in Appendix B. Table 1 summarizes the more important sampling variables. Refer to Appendix C for field data.

Source emission data are summarized in Table 2. The laboratory analysis report is located in Appendix D.

TABLE 1: SUMMARY OF SAMPLING VARIABLES

TEST NUMBER	1	2	3
SAMPLING DATE	July 5, 1984	July 5, 1984	July 5, 1984
SAMPLING DURATION, minutes	60	60	60
SAMPLING VOLUME @ METER CONDITIONS, m^3	1.0355	1.0140	1.0516
SAMPLING VOLUME @ STANDARD CONDITIONS*, dscm	0.9358	0.9036	0.9323
AVERAGE GAS METER TEMPERATURE, °C	43	47	49
ORIFICE PRESSURE DROP, mm H_2O	28.1	26.9	27.9
STACK STATIC PRESSURE, mm H_2O	+4.6	+4.6	+4.6
AVERAGE STACK GAS TEMPERATURE, °C	72	71	73
AVERAGE STACK GAS VELOCITY, m/s	13.8	13.0	13.7
ISOKINETIC FACTOR, %	98.2	101.1	99.1

*Standard Conditions are 25°C and 760 mm Hg

TABLE 2: SOURCE EMISSION SUMMARY

TEST NUMBER		1	2	3	AVERAGE
STACK GAS COMPOSITION DRY BASIS, % BY VOLUME	CO_2	1.0	1.0	1.0	-
	O_2	17.4	17.4	17.6	-
	CO	0.6	0.5	0.5	-
STACK GAS MOISTURE, % BY VOLUME		20.4	22.0	21.0	21.1
Ms**, g/g-mole		26.51	26.34	26.45	-
AVERAGE STACK GAS VOLUMETRIC FLOW RATE, dscm/h		15,790	14,698	15,611	15,366
CONCENTRATION OF PARTICULATE IN THE STACK GAS, g/dscm:		0.02	0.03	0.06	0.04
EMISSION RATE OF PARTICULATE, kg/h		0.39	0.49	0.80	0.56

** Molecular Weight of the Stack Gas on a Wet Basis

DISCUSSION

As reported in Table 2 the concentration of particulate matter in the stack gas for test 3 was two to three times that of the first two tests. This could be a reflection of higher feed rate to the Heil rotary drier or other changes in the process. Unfortunately Mohawk does not record stillage feed rate to the Heil drier on an hourly basis. This makes direct comparison between feed rate and emission rate impossible.

Other factors such as stack gas composition, temperature and velocity were quite uniform throughout the testing program.

CONCLUSION

The results of the three source emission tests indicate that during the survey the average particulate emission was 0.04 g/dscm. This was in compliance with Clause 1 of Clean Environment Commission Order 962.

The average particulate emission rate was 0.56 kg/h.

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1. Mowhawk Oil Company Ltd. Minnedosa Ethanol Distillery; submission to: The Clean Environment Commission. W. L. Wardrop & Associates Ltd. Winnipeg, June, 1981.

2. Standard Reference Methods of Source Testing: Measurement of Emissions of Particulates from Stationary Sources", Report EPS 1-AP-74-1, Air Pollution Control Directorate, Environment Canada, February, 1974.

APPENDIX A: EQUIPMENT CALIBRATION DATA

APPENDIX B: VELOCITY PROFILES

APPENDIX C: FIELD DATA SHEETS

APPENDIX D: ANALYTICAL REPORT

APPENDIX A: EQUIPMENT CALIBRATION DATA

S-TYPE PITOT TUBE CALIBRATION

PROBE SIZE (ft): 5 — CALIBRATION #: 84-8

PROBE LINER: SS — DATE: March 27, 1984

PROBE MANUFACTURER: RAC — BAROMETRIC PRESSURE (Hg): 29.07

TIP SIZE (inches): 0.250 — AMBIENT TEMP. (°C): 20.2

TIP TYPE: SS — OPERATOR: KR, AS

STACK THERMOCOUPLE: ☒ PRESENT ☐ ABSENT

HP 97 INPUT/OUTPUT

Temp: 20.2 °C	4.03 Δ p (std)	8.00 Δ p (std)
Bar. Press: 29.02 In. Hg	42.842607	60.362658
Scale Factor: 0.1	6.21 Δ p (s-pitot)	12.37 Δp(s-pitot)
	0.803562	0.802182
	42.851585	60.375309

0.92 Δ p (std)	5.13 Δ p (std)	9.16 Δ p (std)
Tunnel Velocity: 20.469973 ft/sec	48.337262	64.590865
1.42 Δ p (s-pitot)	7.93 Δ p (s-pitot)	14.48 Δp(s-pitot)
Cp, at this: 0.802902 velocity	0.802297	0.793371
Tunnel Velocity: 20.474263 (using Cp)	48.347392	64.604401

1.97 Δ p (std)	6.10 Δ p (std)	
29.954114	52.709425	
3.06 Δ p (s-pitot)	9.48 Δ p (s-pitot)	0.800849 Cp (ave)
0.800360	0.800154	0.003030 Std. Dev.
29.960391	52.720472	8 Deg. of Freedom

3.10 Δ p (std)	6.93 Δ p (std)	
37.575452	56.181067	
4.81 Δ p (s-pitot)	10.72 Δ p (s-pitot)	2.306 t .05
0.800795	0.802014	0.798519 Low Cp
37.583327	56.192841	0.800849 Mean Cp
		0.803178 High Cp

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S-TYPE PITOT TUBE CALIBRATION

PROBE SIZE (ft)	3	CALIBRATION #	84-16
PROBE LINER	Glass	DATE	March 28, 1984
PROBE MANUFACTURER	RAC	BAROMETRIC PRESSURE (Hg)	29.21
TIP SIZE (inches)	0.250	AMBIENT TEMP. (°C)	19.5
TIP TYPE	SS	OPERATOR	KR, AS

STACK THERMOCOUPLE ☒ PRESENT ☐ ABSENT

HP 97 INPUT/OUTPUT

Temp	19.5	°C		3.92	Δ p (std)		8.12	Δ p (std)
Bar. Press	29.21	In. Hg		42.102189			60.595406	
Scale Factor	0.1			6.53	Δ p (s-pitot)		13.56	Δp(s-pitot)
				0.772857			0.771900	
				42.111013			60.608099	
	1.00	Δ p (std)		5.15	Δ p (std)		9.32	Δ p (std)
Tunnel Velocity	21.264817	ft/sec		48.257549			64.918668	
	1.63	Δ p (s-pitot)		8.58	Δ p (s-pitot)		15.63	Δp(s-pitot)
Cp, at this	0.781302	velocity		0.772810			0.770267	
Tunnel Velocity	21.269273	(using Cp)		48.267662			64.932273	
	2.01	Δ p (std)		6.05	Δ p (std)			
	30.148081			52.304533				
	3.26	Δ p (s-pitot)		10.06	Δ p (s-pitot)		0.776112	Cp (ave)
	0.783253			0.773556			0.005684	Std. Dev.
	30.154399			52.315495			8	Deg. of Freedom
	3.27	Δ p (std)		7.02	Δ p (std)			
	38.453469			56.341733			2.306	t .05
	5.27	Δ p (s-pitot)		11.68	Δ p (s-pitot)		0.771744	Low Cp
	0.785745			0.773321			0.776112	Mean Cp
	38.461527			56.353540			0.780481	High Cp

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S-TYPE PITOT TUBE CALIBRATION

PROBE SIZE (ft)	3	CALIBRATION #	84-20
PROBE LINER	SS	DATE	March 9, 1984
PROBE MANUFACTURER	RAC	BAROMETRIC PRESSURE (Hg)	29.20
TIP SIZE (inches)	0.250	AMBIENT TEMP. (^oC)	18.5
TIP TYPE	SS	OPERATOR	KR

STACK THERMOCOUPLE ☒ PRESENT

☐ ABSENT

HP 97 INPUT/OUTPUT

Temp	18.5	°C
Bar. Press	20.20	In. Hg
Scale Factor	0.1	

4.00	Δ p (std)	
42.464223		
6.37	Δ p (s-pitot)	
0.790448		
42.473123		

8.20	Δ p (std)	
60.799515		
13.11	Δp(s-pitot)	
0.788894		

0.88	Δ p (std)	
Tunnel Velocity 19.917486	ft/sec	
1.41	Δ p (s-pitot)	
Cp, at this 0.788034	velocity	
Tunnel Velocity 19.921660	(using Cp)	

5.05	Δ p (std)	
47.713237		
7.95	Δ p (s-pitot)	
0.795014		
47.723236		

8.88	Δ p (std)	
63.270268		
14.10	Δp(s-pitot)	
0.791607		
63.283527		

2.04	Δ p (std)	
30.325521		
3.26	Δ p (s-pitot)	
0.789077		
30.331877		

6.28	Δ p (std)	
53.207519		
9.82	Δ p (s-pitot)	
0.797695		
53.218670		

0.791620	Cp (ave)	
0.003983	Std. Dev.	
8	Deg. of Freedom	

2.90	Δ p (std)	
36.156983		
4.66	Δ p (s-pitot)	
0.786899		
36.164561		

7.04	Δ p (std)	
56.335158		
11.03	Δ p (s-pitot)	
0.796914		
56.346965		

2.306	t .05
0.788559	Low Cp
0.791620	Mean Cp
0.794681	High Cp

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DRY GAS METER & ORIFICE METER CALIBRATION

Lab No 11165 1/2

Dry Gas Meter S/N: Rockwell 711030 — Calibrated by Roots and Test Meter

Atmospheric Pressure: 29.30 in. Hg = 744.2 mm Hg — Calibrated by: Gas Instrument & Tube Farm

Ambient Temperature: 100°F — 22.7°C — Date: 17 June 84

Manometer Orifice ΔH (in. H2O)	Wet Test Meter Volume Vw (Ft.3)	Dry Gas Meter Reading Initial (Ft.3)	Dry Gas Meter Reading Final (Ft.3)	Dry Gas Meter Volume Vd (Ft.3)	Temperature W.T.M. Tw (°F.)	Temperature W.T.M. Tw (°C.)	Temperature D.C.M. Ti (°F.)	Temperature D.C.M. To (°F.)	Time t (Min.-Sec.)	Time t (Min.)	Manometer Setting Δp (in. H2O)	Barometric Pressure Pb (mm. Hg)	W.T.M./D.G.M. Ratio γ (—)	√ (—)	Flowrate Qm (Ft.3/min.)
6 Pos	4.0	891 347	895 537	4.090	64.8	18.2	101	80	10 22 29	10.3712	0.31	15.173	1.0022	0.5624	0.3977
6 Pos	4.0	895 537	899 9?8	4.104	65.0	18.3	103	82	10 32 41	10.3735	0.30	15.372	1.0011	0.5474	0.3889
6 Pos	4.0	899 0?3	903 ?12	4.110	65.1	18.4	102	83	10 24 59	10.4098	0.29	15.231	1.0011	0.5640	0.3981
1 Pos	4.0	898 175	902 303	4.128	65.2	18.4	110	84	7 26 57	7.3445	0.43	15.871	1.0021	0.8057	0.5701
1 Pos	4.0	902 3?5	906 4?8	4.123	65.3	18.5	111	85	7 21 13	7.3523	0.40	15.931	1.0024	0.7965	0.5604
1 Pos	4.0	906 5?7	910 6?8	4.141	65.5	18.6	112	86	7 21 36	7.3510	0.38	15.971	1.0018	0.8072	0.5709
1 Pos	5.0	1914 7?4	1919 9?6	5.182	65.6	18.7	114	87	7 33 71	7.5518	0.50	15.972	1.0009	0.9824	0.6948
1 Pos	6.0	1921 4?4	1927 6?6	6.232	65.6	18.7	114	87	9 04 63	9.0772	0.48	15.972	0.9994	0.9824	0.6948
1 Pos	5.0	1923 3?8	1928 3?0	5.192	65.7	18.7	114	87	7 33 94	7.5540	0.55	15.972	0.9997	0.9824	0.6948
2 Pos	6.0	1931 5?6	1937 7?7	6.233	65.9	18.8	116	88	7 54 03	7.9005	0.64	15.972	0.9995	1.1394	0.8059
2 Pos	6.0	1937 3?4	1943 5?6	6.232	66.0	18.9	116	88	7 53 56	7.8927	0.62	15.975	0.9992	1.1394	0.8059
2 Pos	6.0	1943 1?7	1949 2?9	6.231	66.1	18.9	116	89	7 53 56	7.8927	0.64	15.975	1.0004	1.1404	0.7768

Linear Regression: Intercept (b) 0.0114

Slope (m) 0.995

Coefficient of Determination (r²) 1.000

γ = 1.000 ± 0.001

Δ = ± 2.5%

Comments:

-22-

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DRY GAS METER & ORIFICE METER CALIBRATION DATA

7/2

Dry Gas Meter S/N Rockw 711030 — Calibrated by Rockwell Test Meter

Atmospheric Pressure 29.21 in. Hg = 74.21 cm Hg — Calibrated by Rm. 1 Burners & Inst. Room

Ambient Temperature 19°C — 22.7°C — Date 12 June 81

Laminar Orifice ΔH (in. H_2O)	W.T.M. Volume V_w ($Ft.^3$)	Dry Gas Meter Reading Initial ($Ft.^3$)	Dry Gas Meter Reading Final ($Ft.^3$)	D.G.M. Volume V_d ($Ft.^3$)	Temperature W.T.M. T_w (°F.)	Temperature W.T.M. T_w (°C.)	Temperature D.G.M. T_i (°F.)	Temperature D.G.M. T_o (°F.)	Time θ (Min.&Sec.)	Time θ (Min.)	W.T.M. Manometer Δh (in. H_2O)	Partial Pressure P_w (cm. Hg)	W.T.M./D.G.M. Ratio γ (—)	$\sqrt{\quad}$ (—)	Flowrate Q C.F.P. (cm ($Ft.^3$/min.)
2.53	6.0	959.977	965.595	6.221	66.1	18.9	116	89	7:52.76	7.0960	0.52	74.275	1.0008	1.2724	0.9514
2.53	6.0	966.142	972.919	6.233	66.2	19.0	116	90	7:52.55	7.0592	0.60	74.277	1.0009	1.2735	0.9520
2.53	6.0	972.961	978.820	6.236	66.4	19.1	116	90	7:52.18	7.0947	0.60	74.281	0.9992	1.2735	0.9572
3.05	6.0	984.274	990.498	6.224	66.5	19.2	117	90	6.2944	6.4907	0.71	74.285	0.9992	1.3934	0.9752
3.05	6.0	990.274	996.484	6.210	66.5	19.2	117	90	6.2926	6.4923	0.72	74.285	1.0016	1.3934	0.9758
3.05	6.0	996.484	002.695	6.211	66.6	19.2	117	90	6.2954	6.4890	0.77	74.285	0.9991	1.3934	0.9751
3.54	6.0	016.131	016.737	6.221	66.6	19.2	117	90	5:56.66	5.9443	0.70	74.285	0.9983	1.5046	1.0197
3.54	6.0	619.329	623.645	6.216	66.7	19.3	117	90	5.5588	5.9313	0.73	74.290	0.9987	1.5046	1.0215
3.54	6.0	625.711	631.918	6.207	66.8	19.3	117	90	5.5551	5.9352	0.72	74.290	1.0000	1.5046	1.0224

Linear Regression: Intercept (b) 0.014

Slope (m) 0.665

Coefficient of Determination (r^2) 1.000

γ = 1.000 ± 0.001

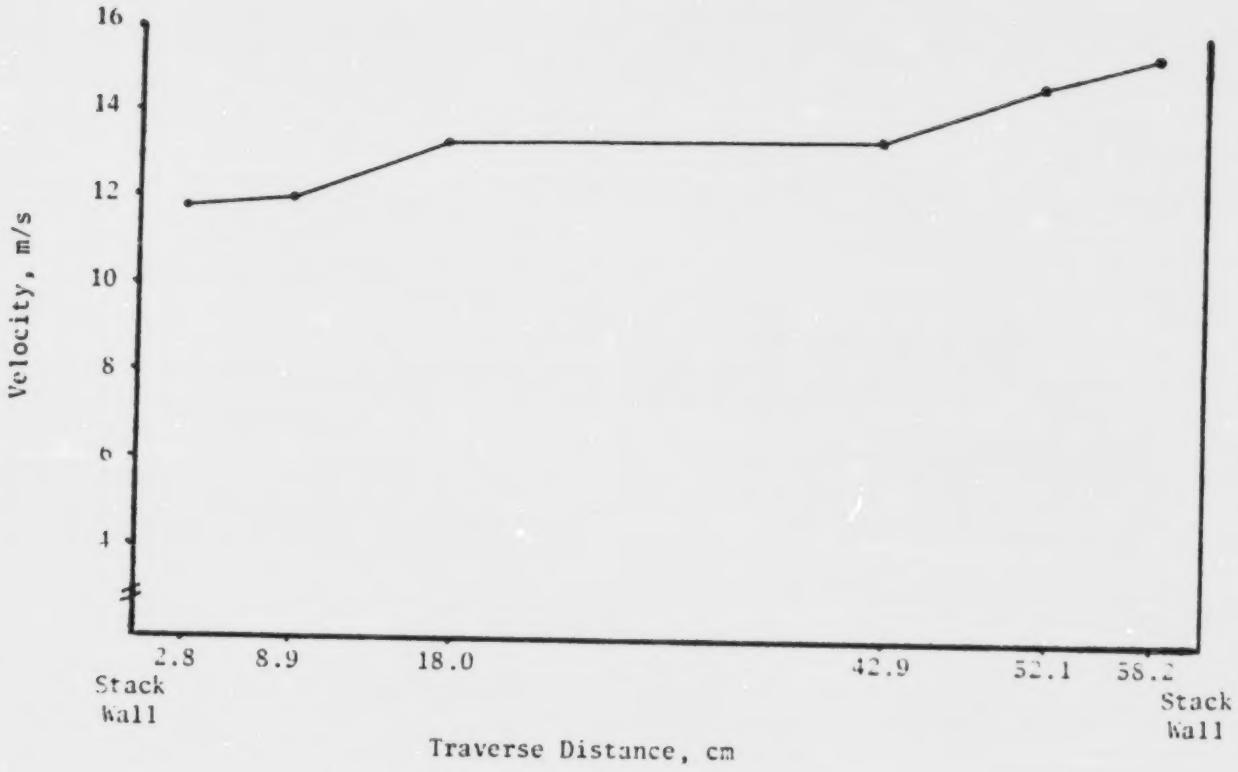
$\Delta H@$ = 2.071

Comments:

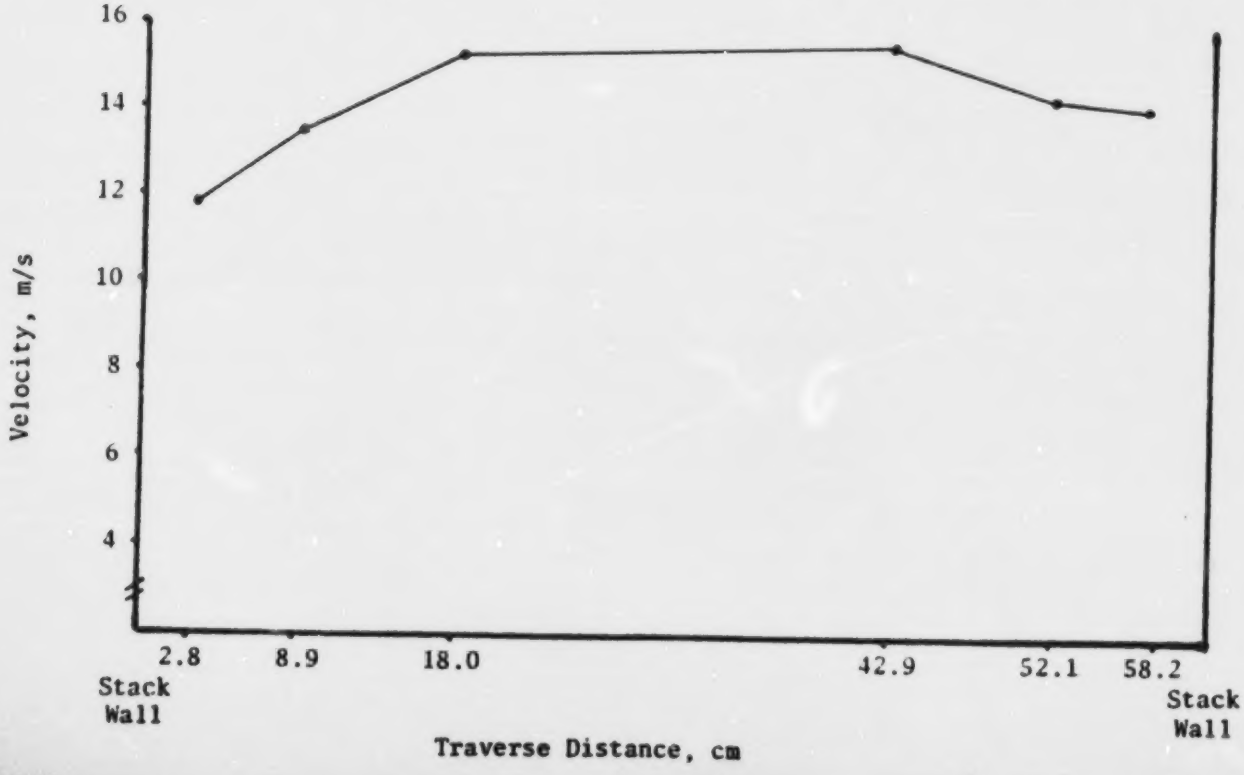
9245 Rev. 9/8/83 JP/cm

APPENDIX B: VELOCITY PROFILES

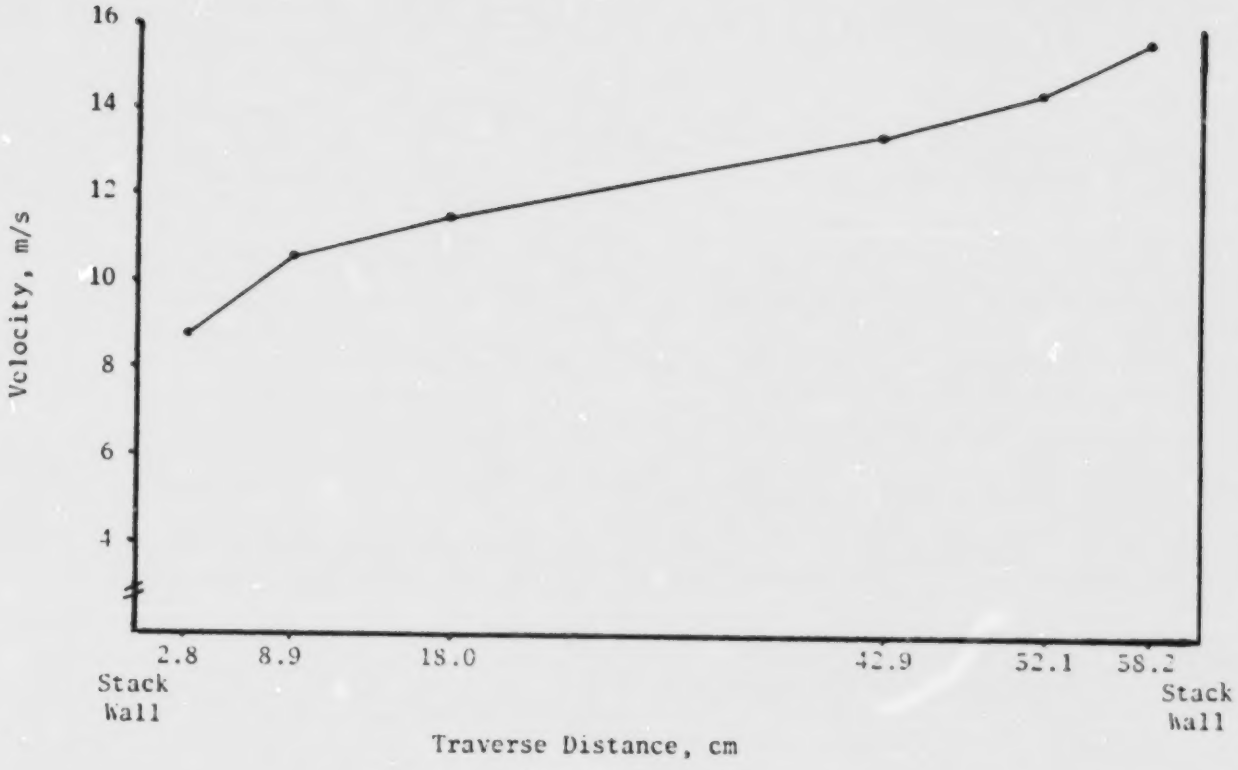
Graph 1. Velocity Profile of Test 1, SW Port. Wind NNW @ 10 to 18 km/h



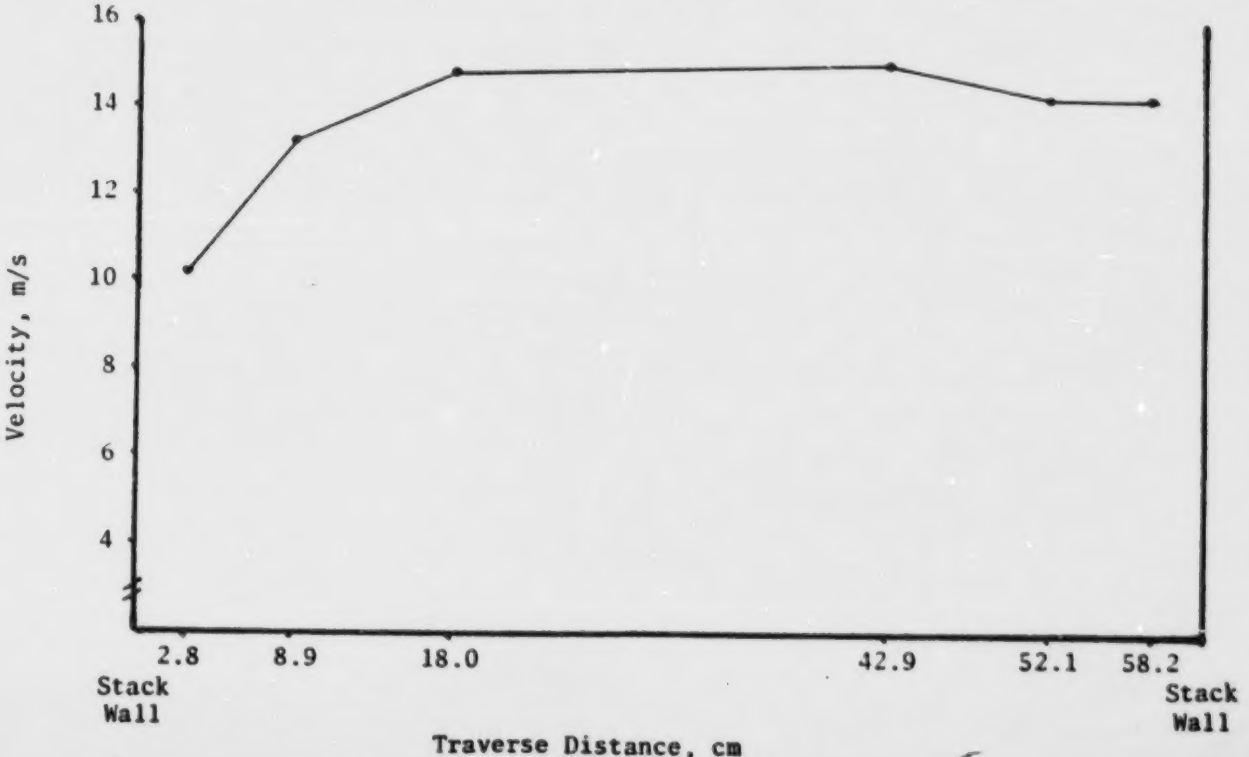
Graph 2. Velocity Profile of Test 1, NW Port. Wind NNW @ 10 to 18 km/h



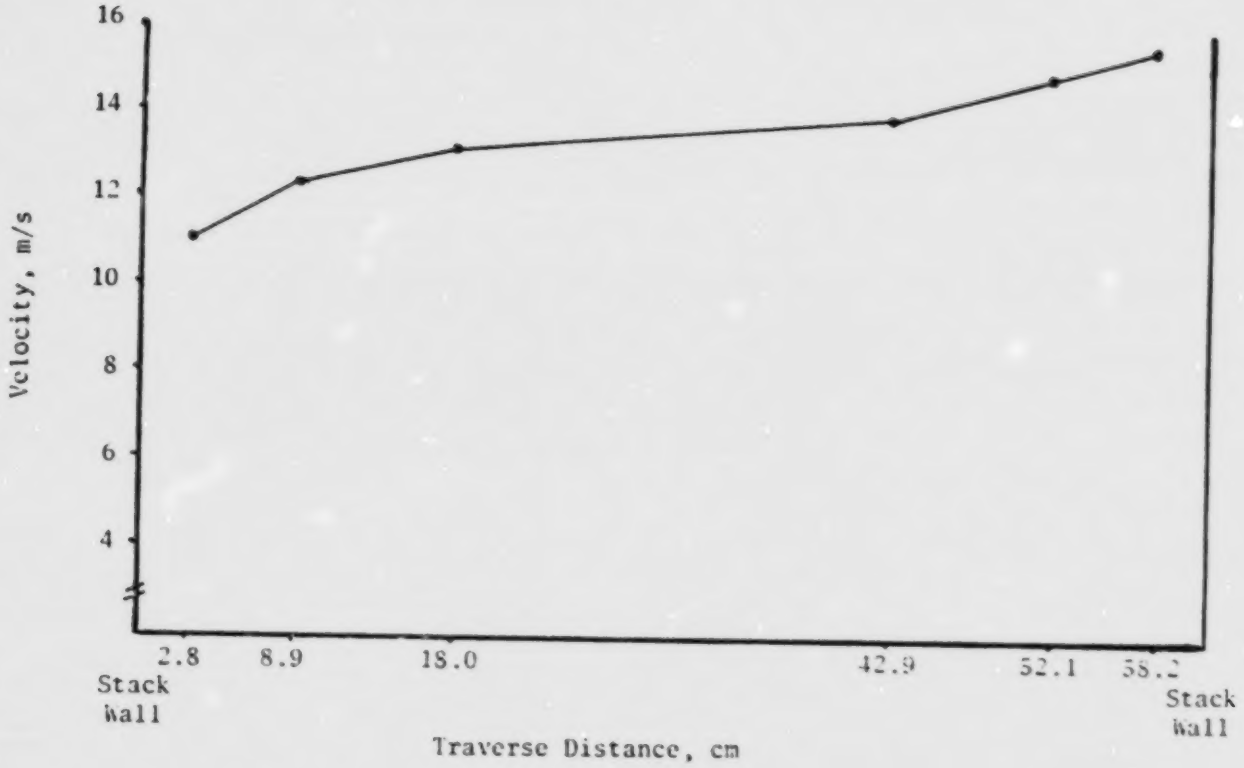
Graph 3 . Velocity Profile of Test 2 , SW Port. Wind NNW @ 10 to 18 km/h



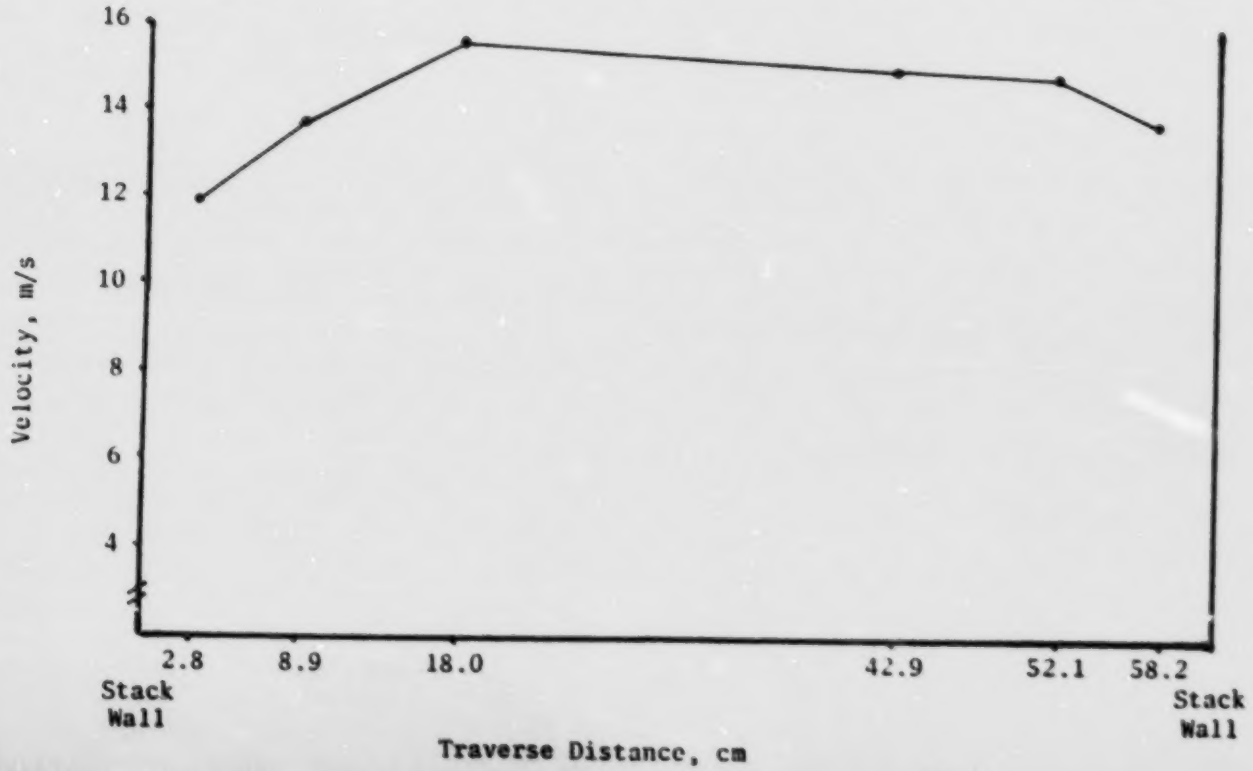
Graph 4 . Velocity Profile of Test 2 , NW Port. Wind NNW @ 10 to 18 km/h



Graph 5. Velocity Profile of Test 3, SW Port. Wind NNW @ 10 to 18 km/h



Graph 6. Velocity Profile of Test 3, NW Port. Wind NNW @ 10 to 18 km/h



APPENDIX C: FIELD DATA SHEETS

FIELD DATA SHEET

Plant Mohawk Oil Company **Location** Minnedosa, Manitoba.

Stack East Stillage Dryer **Test number** 1 **Date** July 5, 1984

Ambient temperature (°F) 63 **Barometric pressure (in. Hg)** 28.51 **Time** 1:05 P.M. to 2:30 P.M.

Nozzle diameter (in.) 0.240 **Probe length/type** 3 feet/stainless steel **Stack static pressure (in. H_2O)** +0.18

Probe temperature (°F) 217 to 280 **Filter holder temperature (°F)** 209 to 254 **Leak check** 0.000 **CFM @** 15 **" Hg Vacuum**

Traverse point number	Clock time, start	Stack gas temperature, °F	Gas meter volume, cu. ft.	Velocity pressure, in. H_2O	Orifice pressure drop in. H_2O	Gas meter temperature, °F		Final impinger Temperature, °F	Pump vacuum in. H_2O	Isokinetic factor, %
						Inlet	Outlet			
SW 1	0	160	2.465	0.40	0.798	99	91	49	3	95.2
2	5	162	2.632	0.42	0.835	108	92	49	3	98.5
3	10	162	2.930	0.52	1.04	117	93	50	5	97.7
4	15	162	2.919	0.52	1.04	124	95	53	5	96.6
5	20	163	3.288	0.63	1.26	127	97	55	7	98.5
6	25	164	3.436	0.69	1.38	129	100	58	7	98.1
NW 1	30	160	2.627	0.40	0.814	112	102	60	3	99.3
2	35	160	2.967	0.52	1.06	121	102	58	5	97.7
3	40	163	3.434	0.67	1.36	129	103	59	7	99.2
4	45	163	3.455	0.68	1.38	132	104	62	7	98.6
5	50	164	3.234	0.58	1.18	135	106	63	5	99.7
6	55	164	3.176	0.56	1.14	137	107	65	5	99.4
Average or total	60	162	36.563	0.55	1.11	-	-	-	-	98.2

FIELD DATA SHEET

Plant Mohawk Oil Company **Location** Minnedosa, Manitoba

Stack East Stillage Dryer **Test number** 2 **Date** July 5, 1984

Ambient temperature (°F) 63 **Barometric pressure (in. Hg)** 28.51 **Time** 3:07 P.M. - 4:20 P.M.

Nozzle diameter (in.) 0.241 **Probe length/type** 3 ft/glass **Stack static pressure (in. H_2O)** +0.18

Probe temperature (°F) 222 to 308 **Filter holder temperature (°F)** 214 to 288 **Leak check** 0.001 **CFM @** 15 **" Hg Vacuum**

Traverse point number	Clock time, start	Stack gas temperature, °F	Gas meter volume, cu. ft.	Velocity pressure, in. H_2O	Orifice pressure drop in. H_2O	Gas meter temperature, °F		Final impinger Temperature, °F	Pump vacuum in. H_2O	Isokinetic factor, %
						Inlet	Outlet			
SW 1	0	150	1.999	0.24	0.502	120	108	56	4	98.5
2	5	158	2.428	0.34	0.705	129	108	54	4	100.3
3	10	160	2.621	0.40	0.822	135	109	56	5	99.3
4	15	164	3.119	0.54	1.11	138	110	58	6	101.7
5	20	165	3.309	0.62	1.27	140	112	63	6	100.5
6	25	164	3.633	0.74	1.52	140	113	66	7	101.1
NW 1	30	154	2.314	0.31	0.635	112	101	52	3	102.0
2	35	157	2.847	0.52	1.07	121	101	52	5	96.3
3	40	161	3.366	0.65	1.32	126	102	54	7	101.8
4	45	162	3.461	0.67	1.36	130	104	62	7	102.6
5	50	163	3.328	0.60	1.22	134	105	64	6	103.9
6	55	163	3.380	0.60	1.22	137	107	66	6	105.0
Average or total	60	160	35.805	0.52	1.06	-	-	-	-	101.1

FIELD DATA SHEET

Plant Mohawk Oil Company **Location** Minnedosa, Manitoba

Stack East Stillage Dryer **Test number** 3 **Date** July 5, 1984

Ambient temperature (°F) 63 **Barometric pressure (in. Hg)** 28.51 **Time** 4:46 P.M. to 6:00 P.M.

Nozzle diameter (in.) 0.240 **Probe length/type** 5 ft/stainless steel **Stack static pressure (in. H_2O)** +0.18

Probe temperature (°F) 225 to 258 **Filter holder temperature (°F)** 216 to 318 **Leak check** 0.000 **CFM @** 15" **Hg Vacuum**

Traverse point number	Clock time, start	Stack gas temperature, °F	Gas meter volume, cu. ft.	Velocity pressure, in. H_2O	Orifice pressure drop in. H_2O	Gas meter temperature, °F		Final impinger Temperature, °F	Pump vacuum in. H_2O	Isokinetic factor, %
						Inlet	Outlet			
SW 1	0	160	2.463	0.34	0.699	118	108	58	4	99.5
2	5	162	2.696	0.42	0.864	125	108	58	5	97.6
3	10	165	2.957	0.48	0.981	130	109	59	5	99.8
4	15	165	3.311	0.53	1.09	135	110	62	5	105.8
5	20	165	3.347	0.61	1.25	139	111	64	5	99.3
6	25	164	3.485	0.67	1.38	140	111	64	5	98.5
NW 1	30	159	2.637	0.39	0.811	125	111	62	4	98.4
2	35	162	3.010	0.52	1.08	132	112	60	4	97.1
3	40	164	3.435	0.67	1.38	135	112	59	5	97.5
4	45	165	3.338	0.62	1.27	136	113	63	5	98.3
5	50	165	3.351	0.61	1.25	138	114	62	5	99.3
6	55	164	3.103	0.53	1.09	139	115	62	4	98.5
Average or total	60	163	37.133	0.53	1.10	-	-	-	-	99.1

APPENDIX D: ANALYTICAL REPORT

R.M. WARD TECHNICAL SERVICES LABORATORY CHEMICAL ANALYSIS FORM II

SUBMITTER: KEVIN REEVE ARC
LOCATION: MINNEDOSA
REPORT TO: K. REEVE
MOHAWK OIL ER-1

SAMPLE – ID: From Y 84 Sequent 12602 To Y 84 Sequent 12610

L – Less than
G – Greater than

Date Sampled: 84 07 05
Date Received: 84 07 06

Sample Number	Identification or Comments	Parameter	LIG	Value	Units	Date Analyzed
12602	PROBE WASHINGS & BEFORE FILTER	TSP		0.0007	g	07/18
12603	IMPINGER 1 & 2 CONTENTS	TSP		0.0120	g	07/18
12604	FILTER # 396	TSP		0.0124	g	84 07 18
12605	PROBE WASHINGS ER. BEFORE FILTER	TSP		0.0011	g	07/18
12606	IMPINGER 1 & 2 CONTENTS	TSP		0.0126	g	07/18
12607	FILTER # 407	TSP		0.0180	g	07 18 0
12608	PROBE WASHINGS ER. BEFORE FILTER	TSP		0.0165	g	07/18
12609	IMPINGER 1 & 2 CONTENTS	TSP		0.0121	g	07/18
12610	FILTER # 414	TSP		0.0229	g	07/18

RECEIVED
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